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(54) OPTICAL BRIGHTENING OF PLASTICS SHEETS AND FILMS

(71) We, HOECHST AKTIENGESELLSCHAFT, formerly known as Farbwerke Hoechst Aktiengesellschaft, vormals Meister Lucius & Brüning, a Body Corporate, organized according to the laws of the Federal Republic of Germany, of 6230 Frankfurt (M)-Hoechst, Federal Republic of Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

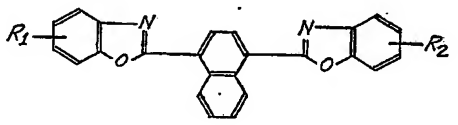
The present invention relates to a process for the optical brightening of plastics sheets and films containing titanium dioxide pigment.

In the manufacture of white shaped plastics sheets and films, a white pigment is incorporated into the plastics material. Titanium dioxide, generally of the rutile type, is predominantly used for this purpose. Under the usual application conditions, the concentration of the pigment in the plastics material has almost no influence on the degree of whiteness but only increases the opacity of the material. The degree of whiteness of the material incorporating the pigment is generally between 70 and 80%. (Throughout this specification the degree of whiteness is calculated according to Berger's formula, *Die Farbe 8* (1959), pages 187—202, based on the remission of magnesium oxide being 100%.)

The degree of whiteness of plastics material pigmented in this manner can be substantially increased by using optical brighteners. In this case, the degree of whiteness obtained depends not only on the concentration of the optical brightener but also, to a considerable extent, on the type of pigment used: for example, if an unplasticized sheet made from polyvinyl chloride in the usual manner and pigmented with 5% by weight of titanium dioxide is brigthened by means of 0.05% by weight of 1,4 - bis - (benzoxazol - 2 - yl) - naphthalene, the degree of whiteness obtained is 98% using rutile, whereas it is 125% using anatase. Thus, although rutile is the preferred pigment in general, it in this case has an unfavourable effect on the degree of whiteness

It has now been found that plastics sheets and films containing titanium dioxide pigment can, irrespective of the type of titanium dioxide, be optically brightened in an optimum manner by applying to the sheet or film a transparent layer in which an optical brightener is dissolved. In this manner, use can especially be made of the valuable properties of rutile as a white pigment for plastics sheets and films without it having a disadvantageous influence on the degree of whiteness obtained.

The optical brightener to be used according to the invention may be any optical brightener that will dissolve in the transparent carrier used. Especially suitable are optical brighteners of the general formula



in which each of R_1 and R_2 which may be identical or different, represents a hydrogen atom, a carboxy group, or an alkoxycarbonyl group, especially one having not more than 5 carbon atoms. The compound in which each of R_1 and R_2 represents a hydrogen atom, namely 1,4 - bis - (benzoxazol - 2 - yl) - naphthalene, is especially preferred.

The optical brighteners are suitably used in the usual concentrations. Where required, the amount to be used can easily be determined by simple preliminary tests. Amounts of from 0.01 to 0.1%, calculated on the total weight of the transparent carrier, are preferably used.

Optically brightened films and sheets manufactured by the present process are laminates

comprising a film or sheet containing titanium dioxide and a transparent layer having dissolved in it an optical brightener. Even if the optical brightener is detrimental to foodstuffs, the laminated whitened film or sheet, containing the brightener and optionally another pigment, can be used in contact with foodstuffs if the transparent carrier prevents migration of the optical brightener. These laminated sheets, which can be manufactured in known manner, by means of suitable machines, have a better degree of whiteness than non-laminated sheets comprising optical brightener and pigment. By using suitably thin laminate, the laminated sheets need be no thicker than a similar non-laminated sheet.

The transparent layer can be, for example, a clear lacquer or varnish, a wax, or a thermoplastics or thermosetting resin. Alternatively, the transparent layer may consist of another plastics film or sheet.

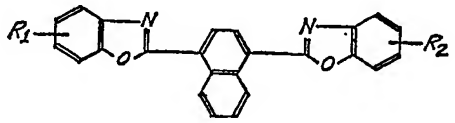
The following Example compares the whiteness of a film produced according to the invention with that of a non-optically brightened film and of a film optically brightened by a known method. (All parts are by weight.)

0.05 Part of 1,4 - bis - (benzoxazol - 2 - yl) - naphthalene, as an optical brightener, was incorporated into a plasticized sheet made from 78 parts of polyvinyl chloride, 22 parts of dioctyl-phthalate, 1.5 parts of a barium-cadmium stabilizer, 5 parts of titanium dioxide (rutile), and 0.5 part of wax. The degree of whiteness of this sheet was 116%. When anatase was used instead of rutile, the degree of whiteness was 150%. The degree of whiteness of a similar sheet but without optical brightener was 65% using rutile, and 75% using anatase. This unbrightened sheet was laminated with an unpigmented transparent film containing 0.05 parts of the above-mentioned optical brightener. The degree of whiteness of the resulting laminate was 165%, independently of the titanium dioxide type used.

WHAT WE CLAIM IS:—

1. A process for the optical brightening of a plastics sheet or film containing a titanium dioxide pigment, which comprises applying to the sheet or film a transparent layer in which an optical brightener is dissolved.

2. A process as claimed in claim 1, wherein the optical brightener is of the formula



in which each of R_1 and R_2, which may be the same or different, represents a hydrogen atom, a carboxy group, or an alkoxycarbonyl group.

3. A process as claimed in claim 1, wherein the optical brightener is 1,4 - bis - (benzoxazol - 2 - yl) - naphthalene.

4. A process as claimed in any one of claims 1 to 3, wherein the plastics sheet or film is of polyvinyl chloride.

5. A process as claimed in any one of claims 1 to 4, wherein the transparent layer is a plastics film or sheet.

6. A process as claimed in any one of claims 1 to 4, wherein the transparent layer is a film, a clear laquer or varnish, a wax, or a thermoplastics or thermosetting resin.

7. A plastics film or sheet optically brightened by a process as claimed in any one of claims 1 to 6.

8. A laminated plastics film or sheet comprising a film or sheet containing titanium dioxide and a transparent layer having dissolved in it an optical brightener.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306 High Holborn,
London, WC1V 7LH.

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